In the United States Court of Federal Claims
OFFICE OF SPECIAL MASTERS

Filed: July 29, 2022

CARLA ADAL and MATTHEW SHIEL, as parents, next of kin, and on behalf of Z.S., a deceased minor,	*	No. 15-1496V
	*	Special Master Sanders
Petitioners,	*	
v.	*	Denial of Entitlement; Pneumococcal Conjugate Vaccine ("PCV"); Haemophilus B Conjugate Vaccine ("HiB-OMP"); Diphtheria-Tetanus-Acellular-Pertussis Hepatitis B Inactivated Polio Vaccine ("DTaP-HepB-IPV"); Table Encephalopathy; Death.
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	
Respondent.	*	

Russell W. Lewis, IV, Johnson Law Group, Nashville, TN, for Petitioner.
Naseem Kourosh, United States Department of Justice, Washington, DC, for Respondent.

DECISION ON ENTITLEMENT[1]

On December 10, 2015, Carla Adal and Matthew Shiel ("Petitioners") filed a petition for compensation under the National Vaccine Injury Compensation Program, 42 U.S.C. § 300aa-10 to -34 (2012).[2] ("Vaccine Act" or "Program"). Petitioners alleged that Z.S., Petitioners' minor child, received pneumococcal conjugate ("PCV13"), haemophilus B conjugate ("HiB-OMP"), and diphtheria-tetanus-acellular-pertussis, hepatitis B, and inactivated polio ("DTaP-HepB-IPV") vaccines on November 18, 2014, and thereafter died on November 19, 2014, and that said death was "caused in fact" by the vaccinations. Pet. at 1, ECF No. 1. Petitioners did not file an amended petition. However, in their post-hearing briefs, Petitioners clarified that "[f]or the reasons argued at the hearing and in [P]etitioners' pre- and post-hearing submissions, [P]etitioners request that the Court find [P]etitioners entitled to compensation based on the existence of a Vaccine Table encephalopathy."[3] Pet'r's Post-Hrg. Br. at 30, ECF No. 67. After carefully analyzing and weighing

[1] This Decision shall be posted on the United States Court of Federal Claims' website, in accordance with the E-Government Act of 2002, 44 U.S.C. § 3501 note (2012) (Federal Management and Promotion of Electronic Government Services). In accordance with Vaccine Rule 18(b), a party has 14 days to identify and move to delete medical or other information that satisfies the criteria in § 300aa-12(d)(4)(B). Further, consistent with the rule requirement, a motion for redaction must include a proposed redacted Decision. If, upon review, I agree that the identified material fits within the requirements of that provision, such material will be withheld from public access.

[2] National Childhood Vaccine Injury Act of 1986, Pub.L. No. 99–660, 100 Stat. 3755. Hereinafter, for ease of citation, all "§" references to the Vaccine Act will be to the pertinent subparagraph of 42 U.S.C. § 300aa (2012).

[3] Encephalopathy is generally defined as "any degenerative disease of the brain." *Dorland's Illustrated Medical Dictionary* 1, 614 (32nd ed. 2012) [hereinafter "*Dorland's*"].

the evidence presented in this case in accordance with the applicable legal standards,[4] I find that Petitioners have not presented preponderant evidence that Z.S. suffered from a Table encephalopathy or that her vaccinations were the cause-in-fact of her death.[5] Accordingly, Petitioners' case is dismissed.

I. Procedural History

On December 10, 2015, Petitioners filed a petition for compensation on behalf of Z.S. Pet. Petitioners allege the pneumococcal, HiB-OMP, and DTaP-HepB-IPV vaccines Z.S. received on November 18, 2014, caused her death. *Id.* Medical records and affidavits from Petitioners were filed along with the petition. Pet'r's Exs. 1–14, ECF Nos. 1-2–1-15. Petitioners filed a statement of completion on December 17, 2015. ECF No. 8. On February 3, 2016, Petitioners filed additional records, including VAERS and fire and police department reports, and an amended statement of completion. Pet'r's Exs. 15–17, ECF Nos. 11–12.

On March 8, 2016, Respondent filed his Rule 4(c) report indicating that this case was not appropriate for compensation. Resp't's Report, ECF No. 13. Thereafter, Petitioners filed an expert report from Dr. Adel Shaker on July 18, 2016. Pet'r's Exs. 18–19, ECF Nos. 19-1–19-2. In response to Petitioners' expert report, Respondent filed a motion to dismiss or, in the alternative, for an order requiring Petitioners to file a supplemental expert report from Dr. Shaker that "more clearly states his theory of causation." ECF No. 22 at 1. Petitioners filed a response to Respondent's motion on September 8, 2016, requesting an opportunity to discuss the deficiencies in their original report and to file a supplemental expert report. ECF No. 24 at 2. The presiding special master ordered Petitioners to file a supplemental expert report. ECF No. 25.

This case was reassigned to me on January 12, 2017. ECF Nos. 26–27. On March 7, 2017, Petitioners filed a supplemental expert report from Dr. Janice Ophoven. Pet'r's Exs. 20–21, ECF Nos. 29-1–29-2. Respondent filed a status report on March 28, 2017, indicating that Petitioners would provide him with the autopsy slides and copies of the autopsy photographs reviewed by their expert in her report. ECF No. 31. On June 9, 2017, Respondent filed an unopposed motion for an extension of time to file his expert reports or, in the alternative, for an order directing Petitioners to file a supplemental expert report specifying information regarding the autopsy slides relied on by Petitioners' experts. ECF No. 32. I granted Respondent's motion and ordered Petitioners to file a supplemental expert report with more specificity regarding the autopsy slides. ECF Nos. 33–34. Petitioners filed a supplemental expert report from Dr. Ophoven on July 12,

[4] While I have reviewed all of the information filed in this case, only those filings and records that are most relevant to the decision will be discussed. *Moriarty v. Sec'y of Health & Hum. Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) ("[w]e generally presume that a special master considered the relevant record evidence even though he does not explicitly reference such evidence in his decision.") (citation omitted); *see also Paterek v. Sec'y of Health & Hum. Servs.*, 527 F. App'x 875, 884 (Fed. Cir. 2013) ("[f]inding certain information not relevant does not lead to—and likely undermines—the conclusion that it was not considered.").

[5] Petitioners unequivocally stated that they did not provide, and the record does not show, a biological mechanism pursuant to *Althen* prong one. *See* Pet'r's Post-Hrg. Br. at 30; Resp't's Resp. at 19; Tr. 167–69. Instead, they wished to proceed on a claim of Table encephalopathy. Therefore, a more thorough discussion of Petitioners' causation-in-fact claim is unnecessary.

2017. Pet'r's Ex. 22, ECF No. 35-1. Respondent provided responsive expert reports from Dr. Sara Vargas, Dr. Max Wiznitzer, and Dr. Sandra Alexandrescu on August 31, 2017. Resp't's Exs. B, B Tabs 1–3; C–G, ECF Nos. 38-1–38-9. Respondent filed the medical literature referenced in his reports on September 15, 2017. Resp't's Exs. F, Tabs 1–8, ECF Nos. 39-1–39-8.

I scheduled this matter for an entitlement hearing to take place on May 4–5, 2020. Hrg. Order, ECF No. 42. Petitioners filed their pre-hearing brief on February 28, 2020. Pet'r's Br., ECF No. 46. On March 30, 2020, Respondent submitted his responsive pre-hearing brief. Resp't's Resp., ECF No. 47. I held a status conference with the parties on April 1, 2020, to discuss the implications of the COVID-19 pandemic. Min. Entry, docketed Apr. 2, 2020. The next day, I cancelled the entitlement hearing and ordered Petitioners to file a status report indicating how they wished to proceed. Non-PDF Order, docketed Apr. 2, 2020. Petitioners filed a status report on June 30, 2020, requesting to reschedule the entitlement hearing. ECF No. 51.

I rescheduled this matter for an entitlement hearing on February 22–23, 2021. Hrg. Order, ECF No. 54. Respondent resubmitted medical literature and updated curriculum vitae per each expert on February 16, 2021. Resp't's Exs. G–R, ECF Nos. 57-1–57-12. Petitioners resubmitted highlighted medical literature the same day. Pet'r's Exs. 23–27, ECF Nos. 59-1–59-5. On February 22, 2021, Petitioners filed an updated medical record. Pet'r's Ex. 28, ECF No. 60-1. The entitlement hearing was held as scheduled on February 22–23, 2021. *See* Min. Entry, docketed Feb. 23, 2021. Petitioners filed their opening post-hearing brief on June 14, 2021. Pet'r's Post-Hrg. Br., ECF No. 67. Respondent filed his responsive post-hearing brief on July 28, 2021. Resp't's Resp., ECF No. 72. On September 1, 2021, Petitioners filed their reply brief. Pet'r's Reply, ECF No. 74. This matter is now ripe for consideration.

II. Factual History[6]

a. Medical Records

Z.S. was born healthy on July 23, 2013. Pet'r's Ex. 3 at 1, ECF No. 1-4. Her medical records document no relevant medical concerns during her first fifteen months of life. She was regularly seen for well-baby check-ups with normal, age-appropriate development. *See generally* Pet'r's Ex. 5, ECF No. 1-6. Z.S. received her childhood vaccinations without any reported adverse effects. *See id*. Z.S.'s medical records chart her growth from birth:

Date	Age	Height	Percentile	Weight	Percentile	Head Circumference	Percentile
7-26-2013	1 day	18.5 in. [46.99 cm]		6.75 lbs.		[13.19 in.] 33.5 cm	
7-31-2013	5 days	19.75 in. [50.17 cm]	25-50th	6.6 lbs.	10-25th	[13.09 in.] 33.25cm	5-10th
10-1-2013	2 mos.	23.75 in. [60.33 cm]	90-95th	12.4 lbs.	10-25th	[14.96 in.] 38cm	25-50th

[6] Both Petitioners provided affidavits in this case. The affidavits did not contain any new information or details inconsistent with the narrative provided to police and reflected in the case report. *See* Pet'r's Exs. 1–2, ECF Nos. 1-2–1-3.

8-26-2014	13 mos.	29.75 in. [75.57 cm]	57th	19 lbs.	12th	[17.13 in.] 43.5 cm	8th
11-18-2014	15 mos.	31 in. [78.74 cm]	58th	20.6 lbs.	11th	[17.52 in.] 44.5 cm	12th

Pet'r's Ex. 5 at 7–11.

On November 18, 2014, Z.S. presented for her fifteen-month well-child check-up. *Id.* at 3. During that visit, Z.S. received pneumococcal, HiB-OMP, and DTaP-HepB-IPV vaccines. *Id.* The vaccines were administered at approximately 9:30 a.m. *Id.*; *see also* Pet'r's Ex. 1 ¶ 5. The medical records do not indicate any adverse reaction. *See generally* Pet'r's Ex. 5. Petitioners did not submit additional medical records.

b. Police and Fire Department Reports

On November 19, 2014, at 7:36 a.m., Ms. Adal called 911 to report that Z.S. was not breathing. Pet'r's Ex. 17 at 3, ECF No. 11-3. Mr. Shiel began CPR per the operator's instructions, but upon arrival, EMS found Z.S. unresponsive and with "conclusive signs of death including dependent lividity[7] and rigor mortis."[8] *Id.*; Pet'r's Ex. 16 at 6, ECF No. 11-2. The police incident report contained statements from Petitioners. *See* Pet'r's Ex. 17. They reported that Z.S. had received three vaccines in her thighs the morning before, but "t[ook] the shots well." *Id.* at 3. Ms. Adal stated that she did not notice anything out of the ordinary. *Id.* at 4. She noted Z.S. was "running warm and it was believed that she might have a fever." *Id*. Ms. Adal "went through the rest of her day holding [Z.S.] to comfort her," and after dinner, gave Z.S. Children's Tylenol for her fever. *Id.* Ms. Adal reported that at approximately 6:30 p.m., she changed Z.S. and placed her on her back in her crib. *Id.* Z.S. reportedly fell asleep without crying. *Id*.

The fire department report notes Mr. Shiel "heard [Z.S.] coughing [during the] night." Pet'r's Ex. 16 at 5–6. The police incident report reflects that Petitioners did not hear Z.S. or check on her during the night. *See* Pet'r's Ex. 17 at 4. Mr. Shiel stated that he "assumed [his three children] were all asleep." *Id.* The next morning, Mr. Shiel discovered Z.S. face down, motionless, and cold. *Id.* Mr. Shiel told police that he "could see the livor mortis[9] already set and knew that [Z.S.] was most likely beyond resuscitation." *Id.* Despite his fears, he moved her to the master bedroom and began CPR while Ms. Adal called paramedics. *Id*.

Coroner investigator Priscilla Chavez arrived on scene and noted that rigor mortis was passing and that liver mortis was set. Pet'r's Ex. 8 at 12, ECF No. 1-9. There were no signs of outward trauma. *Id.* Investigator Chavez pronounced Z.S. dead at 9:50 a.m. *Id.* at 11. There were

[7] Lividity refers to "the quality of being livid; discoloration, as of dependent parts, by the gravitation of the blood." *Dorland's* at 1069.
[8] Rigor mortis is "the stiffening of a dead body, accompanying the depletion of adenosine triphosphate in the muscle fibers." *Dorland's* at 1647.
[9] Livor mortis is another word for lividity. It is defined as the "discoloration appearing on dependent parts of the body after death, as a result of cessation of circulation, stagnation of blood, and settling of the blood by gravity[.]" *Dorland's* at 1069.

no signs of criminal activity. *See id.* The police investigation was "closed non-criminal." Pet'r's Ex. 17 at 5.

c. Autopsy

An autopsy was performed on November 20, 2014. Pet'r's Ex. 8 at 1. The final pathologic findings reflected "(I) Moderate cerebral edema;"[10] and "(II) Status post routine childhood immunizations (A) Reported constitutional symptoms of lethargy, mild temperature elevation, fussiness; (B) Mild acute inflammation and hemorrhage of injection sites." *Id*. The coroner stated:

> This is a 15-month-old female [who] underwent a complete autopsy . . . She reportedly had constitutional symptoms following routine childhood immunization and was treated with acetaminophen. She was found deceased, prone in her crib, the morning following her immunizations. Despite extensive testing, no cause of death was identified, and no unequivocal link between her death and immunizations was established. For these reasons, the cause and manner of death are listed as undetermined.

Id.

The coroner noted that Z.S.'s bacterial cultures and a metabolic screen were negative but that her viral screen was positive for rhinovirus/enterovirus.[11] *Id*. at 8.

III. Fact Testimony

a. Ms. Carla Adal

Ms. Adal testified at the hearing largely to the same information she provided to the police on November 19, 2014. *See* Pet'r's Ex. 17. She also provided additional details from November 18, 2014, and the morning of November 19, 2014. Ms. Adal testified that following Z.S.'s vaccinations on November 18, 2014, she put Z.S. down for a nap but noted she "napped longer than usual." Tr. 22:2. Ms. Adal said Z.S. was "fussier than normal," and noted that "[i]t was very clear [to Ms. Adal] that [Z.S.'s] legs were hurting." Tr. 23:17, 24:2–3. Ms. Adal described Z.S. as "extra tired and just lethargic." Tr. 24:18. Z.S. also did not want to play or eat. Tr. 25:6–7. Ms. Adal stated that Z.S. "was just blah. Very blah." Tr. 25:7–8. When compared to Z.S.'s post-vaccination condition from prior vaccinations, Z.S. "was in a lot more pain," and "she slept longer this time." Tr. 28:18–22.

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[10] Cerebral edema is the "excessive accumulation of fluid in the brain substance; causes include trauma, tumor, and increased permeability of capillaries as a result of anoxia or exposure to toxic substances." *Dorland's* at 593.

[11] Rhinovirus is "a genus of viruses of the family *Picornaviridae* that infect the upper respiratory tract and cause the common cold. Over 100 antigenically distinct types infect humans; bovine and equine rhinoviruses have also been isolated." *Dorland's* at 1640. Enterovirus is "a genus of viruses of the family *Picornaviridae* that preferentially inhabit the intestinal tract. Infection is usually asymptomatic or mild but may result in a variety of disease syndromes[.]" *Id.* at 626–27.

Ms. Adal testified that she did not believe that she heard any sounds from Z.S. on the night of November 18, 2014, "because normally, she would wake [Ms. Adal] up[,]" but she did not on that occasion. Tr. 30:12–13.

On cross-examination, Ms. Adal was asked about her statement to police that she did not notice Z.S. acting differently after her vaccinations. Tr. 42:9. Ms. Adal stated that originally, she thought her daughter was just exhibiting the normal level of tiredness from her vaccinations and was "quieter[.]" Tr. 42:14–19. She noted that since that time, she has had the benefit of hindsight. Tr. 42:15–16. Ms. Adal confirmed that post vaccination, Z.S. could hear her mother's voice and other sounds around her. Tr. 52:24–25, 53:1. Z.S. could also look at objects and she recognized her mother, father, and brothers. Tr. 53:2–15. Ms. Adal testified that Z.S. did not vomit or indicate that her head was hurting. Tr. 53:16–22. Ms. Adal did not "witness a seizure" or "notice the loss of consciousness." Tr. 54:12–16. She also testified that Z.S. was able to respond to her own name. Tr. 54:22–23.

b. Mr. Matthew Shiel

Mr. Shiel described Z.S. as "kind of floppy" when he came home on the day she received her vaccinations. Tr. 65:12. He testified that she "was[not] her usual bouncy, energetic self[]" and noted that "she seemed weighed down by her own weight." Tr. 73:12–16. Mr. Shiel agreed that "[l]ethargic would be a great word" to describe Z.S. Tr. 74:15. He continued, "she was hot, and she was[not] her normal self." Tr. 65:13–14. Mr. Shiel said he was not concerned about Z.S.'s condition at that time because he is "a firm believer [that his] children are very healthy . . . and the body normally fixes itself." Tr. 66:9–12. He noted that Z.S. specifically was "incredibly healthy" and met her developmental milestones. Tr. 75:20. Z.S. could turn over in her crib if need be. Tr. 76:2–5. Mr. Shiel confirmed that he knew Z.S. was dead when he found her the morning of November 19, 2014. Tr. 71:13–14. He testified that Z.S. "was perfectly conscious up until the time she died in her sleep." Tr. 66:25–67:1. Mr. Shiel expressed frustration about Z.S.'s level of consciousness. He stated, "she did[not] have any decreased consciousness until she died in her sleep in a room by herself." Tr. 76:16–18. Mr. Shiel did not remember telling the police that he heard Z.S. coughing during the night. Tr. 82:24. He clarified that "if there had been any type of noise from [Z.S.] that sounded unusual, then [he] would have responded." Tr. 83:3–5.

IV. Experts[12]

a. Petitioners' Expert, Janice Ophoven, M.D.

Dr. Ophoven received her medical degree from the University of Minnesota in 1971. Pet'r's Ex. 21 at 1, ECF No. 29-2. Dr. Ophoven completed residencies in pediatrics and anatomic pathology at the same institution in 1976 and 1979, respectively. *Id.* She completed a fellowship in pediatric pathology at the University of Minnesota and Minneapolis Children's Medical Center in 1979. *Id.* In 1980, she completed an additional fellowship in forensic pathology at the Hennepin County Medical Examiner's Office in Minneapolis, MN. *Id.* Dr. Ophoven is board certified in pathology and forensic pathology. *Id.* at 1–2. Dr. Ophoven served as the Associate Director, and

[12] Petitioners clarified at the hearing that they would not be relying on Dr. Adel Shaker's expert report in this matter and would not be citing to it in any post-hearing briefs that I allow. Tr. 189:11–14.

later the Director, of the St. Paul's Children's Hospital Laboratories from 1981–1985 and 1985–1988, respectively. *Id.* at 2. She also served as the Deputy Medical Examiner of Hennepin County from 1989–1992. *Id.* From 2002–2003, Dr. Ophoven served as a forensic pathologist for several midwestern counties. *Id*. She performed the same role at the Minnesota Regional Coroner's Office for several other counties from 2003–2012, and simultaneously for the St. Louis County Medical Examiner's Office from 2003–2010. *Id.* Since 1981, Dr. Ophoven has participated in independent consultations in the field of pediatric forensic pathology. *Id.* She holds numerous memberships in several professional and scientific societies and committees. *Id.* at 3–4. Her curriculum vitae lists approximately 128 publications, including articles, abstracts, book chapters, and presentations of which she is a listed author. *See id.* at 4–12.

During the hearing, Dr. Ophoven explained that she practices in "the field of injuries in children . . . especially issues having to do with understanding how children die suddenly and unexpectedly." Tr. 90:2–6. Dr. Ophoven asserted that over her approximate forty-year career, she has "made a significant contribution to not only the body of knowledge having to do with sudden death in children, but also the principles of forensic pathology applying to sudden death in childhood." Tr. 90:25–91:1–3. She noted that during her time as a forensic pathologist, she has "performed literally hundreds of autopsies on children mostly less than two years of age." Tr. 93:11–12. Dr. Ophoven testified that she also teaches pediatric pathologists, emergency physicians, and child abuse center personnel "the pathology and the process of investigating sudden and unexpected death." Tr. 93:17–20. Petitioners offered Dr. Ophoven as an expert in pediatric forensic pathology without objection, and I recognized her as such. Tr. 95:25–96:1–13.

Dr. Ophoven provided two expert reports in this case and testified at the entitlement hearing. Pet'r's Exs. 20, 22, ECF Nos. 29-1, 35-1; Tr. 88–180. Her first report was largely a recitation of Z.S.'s medical history and the facts surrounding her death. *See* Pet'r's Ex. 20. Dr. Ophoven provided her opinion on the last two pages. *Id*. at 12–13. She noted the "examiner identified moderate cerebral edema, with some widening of the gyri[13] and narrowing of the sulci."[14] *Id*. at 12. Dr. Ophoven opined that "brain swelling in and of itself constitutes encephalopathy as broadly defined – a disease, damage or malfunction of the brain." *Id*. Dr. Ophoven reiterated that brain swelling is a "diffuse disease of the brain alteration, pathological change." Tr. 153:22–23. She further opined that Z.S.'s condition also meets the definition of a Vaccine Injury Table encephalopathy. Pet'r's Ex. 20 at 12–13. She explained "[Z.S.] was too old for the diagnosis of [sudden infant death syndrome ("SIDS")][15] or positional asphyxia."[16] *Id.* at 13. She classified Z.S.'s "death as sudden death in infancy associated with cerebral edema following triple childhood vaccination." *Id.*

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[13] Gyri, or singular gyrus, is "one of the convolutions of the surface of the cerebral hemispheres [of the brain] caused by folding of the cortex[.]" *Dorland's* at 813.

[14] Sulci, or singular sulcus, is the "1. anatomic terminology for a long groove or furrow, especially one of the cerebral sulci. 2. a linear depression or valley in the occlusal surface of a tooth, having sloping sides that meet at an angle." *Dorland's* at 1797.

[15] Sudden infant death syndrome is "the sudden and unexpected death of an apparently healthy infant, typically occurring between the ages of 3 weeks and 5 months, and not explained by careful postmortem studies[.]" *Dorland's* at 1850.

[16] Positional asphyxia refers to the "pathologic changes caused by lack of oxygen in respired air, resulting in hypoxia and hypercapnia[,]" caused by one's position. *See Dorland's* at 166.

In a supplemental report, Dr. Ophoven asserted that the brevity of her initial report could be explained by the "straightforward and basic pathological changes characteristic of cerebral edema observed in the gross examination[,] as well as the microscopic tissue examination[,]" of Z.S. Pet'r's Ex. 22 at 1. Dr. Ophoven relied on the autopsy and "the postmortem photographs [that] show brain swelling." *Id*. She noted that her examination "showed a characteristic pathological change known as spongiosis[,][17] consisting of widespread vacuolization of cells due to excess intercellular fluid." *Id*. at 2. She asserted that "[f]rankly, no more description is necessary." *Id*. During the hearing, Dr. Ophoven expanded on this idea. Dr. Ophoven defined spongiosis as vacuolization, or "a change of the cells that shows clearing between the cell membrane and the nucleus." Tr. 151:23–25. She testified that she indeed saw evidence of spongiosis on Z.S.'s brain slides. Tr. 152:13–15.

Dr. Ophoven's testimony indicated that unlike a hospital-based autopsy, which "delineate[s] pretty exhaustively the effects of care," the forensic autopsy "is actually the proof that sits underneath the manner and circumstance[,] as well as the cause of death." Tr. 97:11, 21–23. She added that the forensic report should also include "the other significant conditions that are likely to have contributed to or were important to the forensic pathologist in making their opinion." Tr. 98:1–4. Forensic pathologists are "taught that the first thing that[is] on the list should summarize the most important finding." Tr. 99:11–13.

Dr. Ophoven noted two things in this case that the forensic pathologist "considered important." Tr. 99:7. Although the cause and manner of death are listed as undetermined, "moderate cerebral edema and status post childhood immunizations would fit on that line as important to the case but not necessarily causative of the sudden death." Tr. 100:8–11. Dr. Ophoven opined that "the presence of a moderate cerebral edema was not considered secondary or artifact or [as an] unimportant finding" in this case. Tr. 99:13–15. However, Dr. Ophoven acknowledged that "the brain swelling, although obviously present, did not have a fatal consequence attached to it." Tr. 101:1–3. In cases where brain swelling is the cause of death, there should be evidence of "pressure at the brainstem." Tr. 101:4–6. Likewise, Dr. Ophoven noted that "the timing, of course, is important." Tr. 99:24–25. And, based on her "review of how this case was presented, . . . the immunizations had import in determining the circumstances of [Z.S.'s] death." Tr. 99:24–25, 100:1–2. Dr. Ophoven also acknowledged that the pathologist reported "no cause of death identified and no unequivocal link between the death and immunizations." Tr. 101:14–15. She clarified that "[u]ndetermined does[not] mean you do[not] know. It means that there are multiple circumstances under which the death could have occurred." Tr. 101:20–22. Based off the important findings listed in the autopsy report, Dr. Ophoven concluded that the coroner questioned "whether or not [Z.S.'s] death was because of natural causes or whether or not it was an accidental complication of the immunization[s]." Tr. 101:24–25, 102:1.

When asked about SIDS, Dr. Ophoven asserted that "unless there[is] a recognized neurologic deficit, a child of this age would not be vulnerable [to the condition] in a face[]down position." Tr. 106:7–9. She noted that the autopsy indicated that Z.S. was found face down, but Dr. Ophoven did not consider "asphyxia, suffocation, anything like that to be a legitimate part of the differential diagnosis here." Tr. 106:15–17. She later definitively said that in this case, "the

[17] Spongiosis is the "intercellular edema of the epidermis, giving the tissue a spongelike appearance due to the formation of micro[-]vesicles." *Dorland's* at 1755.

brain swelling and excessive brain weight excludes [sic] the diagnosis of SIDS." Tr. 120:16–17. Dr. Ophoven focused on the moderate cerebral edema documented in Z.S.'s case and noted that "[b]rain swelling is in the eye of the beholder certainly, but there is a flattening of the surface of the brain that is appreciated." Tr. 106:23–25. She explained that "the appearance and texture" and "the weight of the brain based on the child's anticipated growth of development really are, at least according to some references, the gold standard for determining [the] degree of brain swelling." Tr. 107:5–10. Dr. Ophoven disagreed with any argument that the swelling in this case occurred postmortem because the pathologist did not make that indication. Tr. 154:1–14. She also "disagree[d] that the changes that were seen in this brain are legitimately attributable to postmortem change because of the extent and the other factors that are present in this case." Tr. 154:18–21. Dr. Ophoven was unable to explain how to distinguish between premortem and postmortem edema. She asserted that "[i]f the pathologist believed it to be a postmortem artifact, they would not have listed it number one on the final diagnosis." Tr. 156:22–24.

The finding of brain swelling was supported, in Dr. Ophoven's opinion, by "some widening of the gyri and narrowing of the sulci." Tr. 110:4–5. She explained that "[w]hen the brain swells, it presses against the cranial vault and it kind of flattens the surface, and it makes the bulges tighter so that the sulci are narrower." Tr. 111:2–5. Dr. Ophoven noted that this finding is not "measurable." Tr. 111:6. She asserted that "by virtue of experience and age-specific criteria of the feel, the texture, the consistency of the brain itself, you are able to make a determination that this brain is swollen compared to a normal child this age." Tr. 112:2–6. The training and experience of the examiner are of paramount importance because the examiner has "to have enough experience examining brains of youngsters to make a distinction between a normal brain and an abnormal brain and then to pass a judgement." Tr. 112:10–12. Dr. Ophoven testified that she agreed with the pathologist's finding that Z.S.'s brain was abnormal. Tr. 113:6–7.

Dr. Ophoven counted Z.S.'s measurements from her well-child exams as another key factor to aid in the examination and interpretation of Z.S.'s brain. She noted that "the child was measured alive on the day of her immunization, November 18th, [2014,] and she was 31 inches, which matched her normal growth curve perfectly." Tr. 121:9–11. Based on this height, Z.S.'s brain weight at autopsy would have been abnormal. Tr. 122:16. This is more reliable, according to Dr. Ophoven, than Z.S.'s autopsy height of 33 inches. Tr. 122:4–9. Dr. Ophoven testified that "rigor mortis was lapsing at the time [Z.S.'s weight] was measured, and the [33 inch] height is [therefore] unreliable." Tr. 122:7–9. Dr. Ophoven argued that measuring Z.S.'s brain weight according to the range for a 33-inch child, which would make her autopsy brain weight normal, "puts her nearly a year older and provides an inaccurate assessment of what a normal brain would be." Tr. 122:13–15.

Dr. Ophoven described encephalopathy as "a reflection of abnormal brain tissue that is typically associated with brain swelling," and diagnosed Z.S.'s brain as encephalopathic. Tr. 114:14–15, 23–24. In support of her diagnosis, Dr. Ophoven relied on the National Institute of Health's ("NIH") description of encephalopathy as "the presence of diffuse disease in the brain that alters brain function or structure." Tr. 123:7–9. She reiterated that this conclusion was based on her training and experience, Z.S.'s brain weight, the pathologist's observation of brain swelling, and the presence of water in the brain cells. Tr. 115:1–4.

When asked about Z.S.'s positive finding for a virus, Dr. Ophoven testified that it was "not a virulent virus . . . that would be expected to take a child suddenly without any preexisting symptomology." Tr. 115:22–25. Dr. Ophoven named myocarditis[18] or encephalitis[19] as examples of evidence of a fatal viral infection. Tr. 116:3–5. Most importantly, there was no evidence of bronchitis.[20] Tr. 116:17–20. Dr. Ophoven concluded that the "[b]rain pathology indicating [the] presence of encephalopathy within 24 hours of triple vaccination with no alternative explanation for the brain swelling indicates [a] causal connection." Tr. 124:4–7.

On cross-examination, Dr. Ophoven admitted that she is not board certified in pediatric pathology or neuropathology. Tr. 125:4–25. She also admitted that she has been retired since 2010. Tr. 125:20. Dr. Ophoven was then asked what Z.S.'s brain weight should have been based on the recorded height at her well-child examination. Tr. 144–45. Dr. Ophoven "would have suggested that [Z.S.'s] brain weight would have been less than 1,000 grams, perhaps even between 8 and 900 grams based on the other organ weights of her heart and kidneys and so forth." Tr. 146:6–8. Dr. Ophoven was then challenged with an approximate average brain weight calculation of 1,050 grams based on a 31-inch child. Tr. 148:5 (citing Pet'r's Ex. 26 at 2, ECF No. 59-4).[21] She responded that she also considered other organ weights, "which put[Z.S.] at a lesser anticipated brain weight." Tr. 148:14–15. Dr. Ophoven acknowledged "error in that [she] did[not] come up with a maximum anticipated brain weight, but [opined] it would have been less than [Z.S.'s recorded] 1,059[]" grams. Tr. 148:16–18.

There was an extensive discussion during cross-examination about how encephalopathic edema can cause death by asphyxia. Although Dr. Ophoven argued that moderate cerebral edema is per se encephalopathy, she conceded that "if the edema itself was the trigger [of Z.S.'s death] then one would expect to see evidence of herniation."[22] Tr. 158:19–21. She noted that "you would[not] expect to see significant cytologic changes beyond what we saw here in the timeframe we are talking about with [Z.S.]." Tr. 159:17–20. Dr. Ophoven further admitted that "there[is] not a straight pathway from encephalopathy to death." Tr. 161:23–24. In cases where edema is fatal, other complications include intercranial pressure and seizures. Tr. 162:4–8. She explained that diminished consciousness, responsiveness, or reflexes could also result from edema, but Z.S. was not at risk for asphyxiation, given her age. Tr. 162:6–8, 20. If, however, Z.S. "was developing brain swelling and reduced consciousness, then any number of scenarios could have interfered with her ability to support her life that [] are implicit in the presence of brain swelling." Tr. 164:16–

[18] Myocarditis is the "inflammation of the muscular walls of the heart." *Dorland's* at 1221.
[19] Encephalitis is generally defined as "inflammation of the brain." *Dorland's* at 612.
[20] Bronchitis is the "inflammation of a bronchus or bronchi; there are both acute and chronic varieties. Symptoms usually include fever, coughing, and expectoration. Chronic forms may involve secondary changes to lung tissue." *Dorland's* at 252.
[21] *Potter's Pathology of the Fetus, Infant and Child – Perinatal, fetal, and embryonic autopsy,* Ch. 16 (Enid Gilbert-Barness eds., 2nd ed. 2008).
[22] Herniation is defined as "the abnormal protrusion of an organ or other body structure through a defect or natural opening in a covering, membrane, muscle, or bone." *Dorland's* at 852. Cerebral herniation refers to the "protrusion of brain substance through the cranium, through either a cranium bifidum, the foramen magnum, or the tentorial notch." *Id.* at 848.

20. Dr. Ophoven was asked about the finding of Tardieu spots[23] during Z.S.'s autopsy as evidence of asphyxia. She stated multiple times that "Tardieu spots have nothing to do with asphyxia." Tr. 165:2–3, 9–10, 20–21. She asserted that "anyone making the comment does[not] know any forensic pathology." Tr. 165:8–9. Z.S. could have suffered from asphyxia "[a]s a secondary complication of the encephalopathy, [but] she would not have asphyxiated just because she was face down." Tr. 165:25, 166:1–2. Dr. Ophoven testified that brain swelling is "enough," with no other factors, to conclude that Z.S.'s death was caused by her vaccines. Tr. 167:18–20.

Dr. Ophoven dismissed evidence of a viral infection. She testified that "there[is] a positive culture," but "no evidence of end organ reactions suggesting [] an upper or lower respiratory viral infection." Tr. 169:23–25, 170:1. Dr. Ophoven acknowledged that the lungs were heavy, and "there was some edema present[;]" but she concluded that in this case it is "not useful." Tr. 171:2–5. She then clarified that heavy lungs and a heavy brain are not analogous because "the lungs vary in weight all the time." Tr. 172:3. She explained that pulmonary edema means "that[is] what it is, there[is] fluid in the lungs and no pathology, and that has no meaning." Tr. 171:16–18. In this case especially, "the [increased] brain weight matches with the microscopic changes and the observations by the pathologist." Tr. 171:20–21. Z.S.'s heavy brain weight, "the presence of fluid in the brain[,] and abnormality seen at autopsy" provided the basis for Dr. Ophoven's encephalopathy diagnosis. Tr. 175:9–11. Dr. Ophoven stated that she cannot identify the biological mechanism that results in encephalopathy and death following vaccination. Tr. 175:3. She opined that Z.S.'s death was vaccine caused because of the timing between vaccination and the lack of a "legitimate alternative[]" during that timeframe. Tr. 176:23–24.

b. Respondent's Expert, Sara O. Vargas, M.D.

Dr. Vargas received her medical degree from the University of Vermont College of Medicine in 1994. Resp't's Ex. C at 1, ECF No. 38-5. Dr. Vargas' post-doctoral training includes a residency in anatomic and clinical pathology at Brigham and Women's Hospital in Boston, MA, completed in 1998. *Id.* She also completed a fellowship in pediatric pathology at Boston Children's Hospital in 1999. *Id.* Dr. Vargas has been a staff pathologist at Boston Children's and Brigham and Women's Hospitals since 1999. *Id.* at 2. She has also served as a consultant pathologist at the Beth-Israel Deaconess Medical Center from 2008–2014. *Id.* Since 2014, Dr. Vargas has been on the consulting staff in the Department of Pathology at the Dana-Farber Cancer Institute in Boston. *Id.* She has also held academic appointments. *Id.* at 1. From 2002–2007, Dr. Vargas served as an assistant professor at Harvard Medical School. *Id.* Since 2007, she has been an associate professor at the same institution. *Id.* She holds numerous editorial roles and has several memberships in professional and scientific societies and committees. *Id.* at 3–6. Her curriculum vitae lists over one hundred publications, including articles, abstracts, book chapters, and presentations of which she is a listed author. *See id.* at 9–32.

During the hearing, Dr. Vargas explained that her pathology training included exposure to forensic pathology. Tr. 191:10–12. Specifically, she "spent a month in a medical examiner's office in Albuquerque, New Mexico . . . two weeks at the San Francisco medical examiner's office[,] and

[23] Tardieu spots are defined as spots of ecchymosis beneath the pleura, pericardium, and conjunctiva following death by suffocation. *Dorland's* at 1756, 1872. Dorland's further defines suffocation as asphyxiation. *Id.* at 1796.

two weeks at the Boston medical examiner's office." Tr. 191:12–16. Within her current clinical practice at two hospitals, she "do[es] a lot of autopsies." Tr. 192:18–19. This includes reviewing autopsies that were done by a state or county medical examiner's office. Tr. 196:9–20. Dr. Vargas noted that she is board certified in anatomic, clinical, and pediatric pathology. Tr. 191:22–24. Respondent offered Dr. Vargas as an expert in general and pediatric pathology without objection, and I recognized her as such. Tr. 199:8–20.

Dr. Vargas submitted an expert report and testified at the entitlement hearing in this case. Resp't's Ex. B, ECF No. 38-1; Tr. 190–310. She opined that "[s]ome features seen at [Z.S.'s] autopsy suggest an asphyxia death." Resp't's Ex. B at 5. She noted "Tardieu spots, thymic petechia,[24] and epicardial petechiae,"[25] which "are characteristically seen in accidental and nonaccidental asphyxia." *Id.* Dr. Vargas also identified evidence of Z.S.'s viral infection. *Id.*

Dr. Vargas could not confirm whether the coroner correctly identified widened gyri and narrow sulci, "as it was not well appreciated in the photographs provided." *Id.* She noted that she consulted with a pediatric neuropathologist to confirm her findings as is standard in autopsy practice. *Id.* Dr. Vargas found the "measured weight of the brain was well in line with [Z.S.'s] height and other organ weights, and this normal weight further supports the absence of any excess brain fluid." *Id.*

In response to Dr. Ophoven, Dr. Vargas noted that "the findings observed in the brain are fully in keeping with postmortem change[.]" *Id.* at 6. In sum, Dr. Vargas found "no antemortem signs or symptoms of brain swelling or other brain disease, no grossly evident features of antemortem brain swelling or other brain disease, and no microscopic features supporting antemortem brain swelling or other brain disease." *Id.*

Dr. Vargas opined it "seems incomplete to confine one's assessment of the anatomic feature only to the brain/neuropathology, and to opine about the cause of death without a full examination of all available histologic material." *Id.* at 7. Dr. Ophoven's reliance on the temporal relationship between vaccination and Z.S.'s death and the lack of an alternative explanation is misplaced, according to Dr. Vargas. *Id.* Dr. Vargas also questioned why Dr. Ophoven discounted positional asphyxia as an alternative cause, noting "positional asphyxia can cause death at any age." *Id.* at 8.

Both Drs. Vargas and Ophoven agreed that Z.S. was beyond the cutoff age for SIDS; however, Dr. Vargas asserted that "[t]his concept of undiagnosed disease has been extended to children dying over the age of 12 months." *Id.* She noted that she has been "involved in reviewing cases for Dr. Hannah Kinney's ongoing study on "sudden unexpected death in childhood." *Id.* At the hearing, Dr. Vargas explained that even after infancy, young children can still suffer from sudden unexpected death, known as "SUDC." Tr. 202:13–16. The term SUDC refers to SIDS-like cases in a child over one year old, where "sudden death occur[s] in a sleep environment." Tr. 208:17–18. Dr. Vargas testified that "you could use the word 'SIDS-like' even though you can[not]

[24] A petechia is "a pinpoint, non[-]raised, perfectly round, purplish red spot caused by intradermal or submucous hemorrhage." *Dorland's* at 1422. Thymic pertains to the thymus. *Id.* at 1924–25.

[25] An epicardial petechia refers to petechiae on the inner layer of the pericardium that is in contact with the surface of the heart. *Dorland's* at 630, 1422.

call it SIDS technically because if the child is even a day over the range, the arbitrarily defined SIDS range, you can[not] use the term." Tr. 206:5–9. The "somewhat arbitrary division is age-based," and the unexpected death of a child over one year old would be characterized as SUDC instead of sudden unexpected death in infants ("SUDI"). Tr. 202:23–24. SUDI, according to Dr. Vargas, "is a less strict category than SIDS[]" and can be used in cases that are unexpected but not entirely undetermined, like where there is an incidence of co-sleeping. Tr. 203:14–21. Undetermined cases do not have the "strong level of certainty" implication that a determined death designation would have. Tr. 204:21–22. Dr. Vargas explained that these deaths could have numerous causes like asphyxia or arrhythmia. Tr. 206:18–20. She then clarified that "if you define SIDS as not having a cause and then once you find a cause, you can[not] call it SIDS anymore." Tr. 207:4–6. Cases that have a suspected cause of death that cannot be conclusively proven could still be labeled undetermined. Tr. 207:23–25. Dr. Vargas noted that there is evidence of several potential causes of death in this case, even if they cannot be proven. Tr. 211:5–9.

To help determine which factors listed in the autopsy report are relevant to cause of death, Dr. Vargas explained that "we start by looking at the child's length or height." Tr. 214:21–22. Next, "we line up the observed weight and the expected weight and then look them over and see if anything seems unusual or out of line with the others." Tr. 215:6–9. Looking at Z.S.'s growth, "she [wa]s still in a greater percentage for height than weight." Tr. 219:23–24. Dr. Vargas also noted that "the pediatrician raised the concern for poor growth – or poor weight gain." Tr. 220:1–3. Dr. Vargas used a child growth chart to determine that Z.S. would have been in the 75th percentile for height, using the numbers from her November 18, 2014 doctor's appointment, or the 95th percentile, using the numbers from the autopsy. Tr. 224:21. Based on her autopsy height (83.8 centimeters), Z.S.'s brain weight was consistent with a child ranging from 20 to 24 months of age. Tr. 221:24–25, 222:1–6. Dr. Vargas acknowledged that during autopsy a child would be still, and "that could be a factor that leads you to think that the medical examiner's measurement is closer[]" to Z.S.'s actual height. Tr. 229:7–9. Dr. Vargas then clarified that with "[e]ither measurement anyway, the brain is still well within expected values." Tr. 229:13–14.

Dr. Vargas addressed the autopsy weights of Z.S.'s organs. Dr. Vargas opined that "the lungs stood out as a bit heavy, particularly the right lung. And the spleen was a bit large." Tr. 222:24–25. The right lung, "is kind of 50 percent more than the expected average for this – for a child this height." Tr. 225:22–23. She explained that this "fit very well with the lung disease that [is seen] under the microscope." Tr. 225:24–25. As support, Dr. Vargas described the "lymphocytes particularly surrounding airways and aggregating there in forming lymphoid aggregates with germinal centers, which is the characteristic feature for follicular bronchitis and follicular bronchiolitis." Tr. 225:25, 226:1–4. She continued that there was accumulation of macrophages in Z.S.'s lungs, "also supporting some physiologic significance to airway disease." Tr. 226:12–13. These findings, along with the positive finding for rhinovirus/enterovirus, "fit[] very well with a viral infection that infected the respiratory tract, including all the way down into the lungs." Tr. 227:13–15. Dr. Vargas did not believe that anything else "stood out to [her] as something that you would want to try to correlate with a potential disease." Tr. 223:1–2. When asked about infection as a possible cause of death for Z.S., Dr. Vargas explained

> Everything falls together that she had a viral infection, that clinical – with the cough, the lung weights, the airway lymphoid hyperplasia and the lung

> macrophages . . . combined with the positive test, that all fits . . . . Some kinds of viral infection that affect airways can overlap with asphyxial [sic] death, suffocation with not getting enough air.

Tr. 235:20–25, 236:1–4.

In addition to viral disease, Dr. Vargas also identified evidence suggestive of asphyxiation. She noted the body's fixed, anterior surface lividity as an indication that Z.S. was lying face down postmortem for some time. Tr. 230:2–4. She opined that Z.S. was in the prone position "probably closer to the beginning of her sleep time than – probably closer to after when she was put down than closer to when she was found." Tr. 230:5–8. Dr. Vargas also noted a stain found near Z.S.'s mouth and nose, Tardieu spots, and epicardial petechiae. Tr. 230:22–24, 231:19–20, 232:2–3. She explained that Tardieu spots "are classically in the literature associated with asphyxia, but they are not very – they are not specific for asphyxia seen in infant causes of death." Tr. 231:16–18. The epicardial petechiae "are most common in SIDS and SIDS-like deaths and asphyxia." Tr. 232:9–10. Dr. Vargas disagreed with Dr. Ophoven and opined that positional asphyxia can occur in children over twelve months and even in adults. Tr. 233:1–2. Dr. Vargas generally discussed several other mechanisms that have been associated with sudden death in young children, including genetic and metabolic disorders and cardiac channelopathies. *See* Tr. 241.

On cross-examination, Dr. Vargas sought clarification of several terms and questions prior to rendering an opinion. She acknowledged that there was no evidence of the cause of death in this case, except for the death itself. She was unable to answer questions about the process of making factual findings, or the certainty of medical practices. Tr. 253:19–20, 254:4–5. Dr. Vargas testified that "there[is] always a lot of variability in how terms are used and there[are] not always clear definitions. And that[is] one of the challenges of pathology." Tr. 257:23–25. Dr. Vargas continued that moderate edema, for example, "has been used to describe physiologic postmortem brain swelling." Tr. 259:5–7. In this case, Dr. Vargas asserted that the lividity preceded the edema, and she would not have included that finding in her autopsy report. Tr. 260:23–24. She would have "put sudden unexpected death in childhood" with a note explaining potential causes. Tr. 261:8–10. Dr. Vargas stated that she "definitely believe[s] that it[is] more likely than not that [Z.S.] died of the other causes and mechanisms [] referenced than a vaccination." Tr. 266:2–5. When asked what was the most likely cause of Z.S.'s death, Dr. Vargas testified that she did not know. Tr. 309:20–21.

c. Respondent's Expert, Sandra Alexandrescu, M.D.

Dr. Alexandrescu received her medical degree from the University of Medicine and Pharmacy, "Victor Babes," in Timisoara, Romania in 2004. Resp't's Ex. G at 1, ECF No. 38-9. Dr. Alexandrescu completed a residency in anatomic pathology at the same institution in 2006. *Id.* She completed a second residency in pathology at the University of Texas Health Science Center in Houston, TX in 2012. *Id.* From 2012–2013, Dr. Alexandrescu completed a fellowship in pediatric pathology at Boston Children's Hospital and Harvard Medical School. *Id.* Dr. Alexandrescu completed a two-year fellowship in neuropathology at the University of California – San Francisco in 2015. *Id.* Dr. Alexandrescu has been a clinical instructor of pathology at Harvard Medical School since 2015. *Id.* She has served as a staff pathologist at Boston Children's

Hospital since 2015. *Id.* at 2. As of 2016, Dr. Alexandrescu has also served as a staff pathologist at the Beth-Israel Deaconess Medical Center, the Dana Farber Cancer Institute, and Brigham and Women's Hospital. *Id.* She holds several editorial roles and has memberships in professional and scientific societies and committees. *Id.* at 2–3. Her curriculum vitae lists extensive publications, including articles, reviews, case reports, abstracts, and presentations or lectures, of which she is a listed author. *See id.* at 6–9.

During the hearing, Dr. Alexandrescu noted that her pathology training included forensic pathology. Tr. 311:8–10. While "in Houston, [she] had to rotate for one month to the [medical examiner]'s office[,] which is quite a busy one." Tr. 311:10–12. Her neuropathology fellowship "also required [her] to go to the San Francisco [medical examiner]'s office . . . where [she] was exposed to all aspects of brain examination[.]" Tr. 311:12–15. As part of her responsibilities at Boston Children's Hospital, she reviews "specimens that are taken at surgery from children . . . under the microscope and render[s] a report." Tr. 312:6–12. Her teaching responsibilities include lecturing on brain findings in sudden infant death. Tr. 314:1–6. Dr. Alexandrescu testified that she is board certified in anatomic, clinical, and pediatric pathology, and neuropathology. Tr. 311:17–20. Respondent offered Dr. Alexandrescu as an expert in pediatric pathology and pediatric neuropathology without objection, and I recognized her as such. Tr. 316:1–15.

Dr. Alexandrescu's expert report includes her detailed assessment of the autopsy slides and coroner's report. Resp't's Ex. F, ECF No. 38-8. Dr. Alexandrescu testified that she was asked "to examine the brain specifically and all medical records." Tr. 316:21–23. She noted that external photographs of Z.S. showed a "pattern of established lividity [that] is remarkably similar to Figure 14.8 in Byard's chapter on SIDS,[26] indicating that the child had been lying prone for a significant time after death." Resp't's Ex. F at 4 (citing Resp't's Ex. F, Tab 1 at 11, ECF No. 39-1). Dr. Alexandrescu was unable to assess the presence or absence of herniation, but available autopsy images "demonstrate [a] brain with a normal pattern of gyri and sulci." Resp't's Ex. F at 4. She determined that "the mild expansion of gyri and narrowing of the sulci described in the forensic report is of the degree that is seen as postmortem expected edema/expansion of the brain, particularly in the absence of herniation and/or a brain of increased weight." *Id.* at 5. This is further supported, in her opinion, by the coroner's statement indicating that an "[e]xamination of the formalin-fixed brain reveal[ed] normal gross architecture, and no obvious abnormalities." *Id.*

She defined encephalopathy as a clinical term that "refers to the fact that the brain does not function well." Tr. 320:20. She noted that "not all cases of brain swelling mean encephalopathy." Tr. 320:24–25. Dr. Alexandrescu provided an example, "edema in the setting of hyponatremia[,]"[27] and noted that "in those cases, you are not really encephalopathic." Tr. 321:2–3. She provided another example when there is a hypoxic ischemic change,[28] stating "you will see edema – that[is] a diffuse type of change." Tr. 321:12–14. Another type of encephalopathy can

[26] Roger W. Byard, *Sudden Death in the Young,* Ch. 14 (Cambridge University Press eds., 3rd ed. 2010).
[27] Hyponatremia is "the deficiency of sodium in the blood." *Dorland's* at 903.
[28] A hypoxic ischemic change refers to hypoxic ischemic encephalopathy. It is defined as "encephalopathy resulting from asphyxia. In infants presumed to have suffered prenatal or perinatal asphyxia, common symptoms are lethargy, feeding difficulties, and convulsions; serious cases may involve necrosis of neurons in the brain with psychomotor retardation and spastic motor deficits such as cerebral palsy. In adults, syndromes range from cortical blindness to irreversible coma." *Dorland's* at 908.

involve a focal change, such as "a tumor and if you have mass effect or if you have a hemorrhage that increased the intracranial pressure more or less acutely." Tr. 321:16–19. Dr. Alexandrescu noted that encephalopathy can also involve brain atrophy[29] and does not necessarily involve swelling. Tr. 322:3–6. She then defined edema "as excessive fluid in a tissue." Tr. 322:23–24.

Dr. Alexandrescu explained that edema can occur postmortem. In support of her position, Respondent submitted an article from the European Journal of Radiology[30] that notes "[d]iagnosing brain edema after death can be difficult." Resp't's Ex. F, Tab 6 at 8, ECF No. 39-6. This is partly due to the tendency of radiologists "to use the same criteria for both living and deceased patients in assessing brain edema." *Id.* at 3. The purpose of this article was "to compare postmortem computed tomography with forensic autopsy regarding their diagnostic reliability to differentiate between pre-existing cerebral edema and physiological postmortem brain swelling." *Id.* During a forensic autopsy, this includes "the subjective assessment of flattened gyri and filled sulci, as well as [a] swollen hippocampus, herniated cerebellar tonsils[,] and a midline shift in cases in which the edema is unilateral." *Id.* The article explains that standard measurements "could not be applied as a reliable method for the differentiation between typical postmortem brain changes and antemortem or agonal brain edema." *Id.* Using tomography, the authors offer "two diagnostic criteria for identifying antemortem brain edema (as opposed to postmortem changes of an otherwise normal brain): (1) the lack the delineation of the temporal horn and (2) tonsillar herniation, especially in the presence of symmetric bilateral herniation." *Id.* Finally, the limitations of the study included an acknowledgement that "the determination of brain edema is also partially based on the pathologist's judgement and experience (an elevated brain weight does not necessarily indicate brain edema)." *Id.* at 9.

Dr. Alexandrescu clarified that brain swelling "does not translate into – increased weight of the brain," herniation, or other changes. Tr. 324:4–7. Modifications to the gyri and sulci can appear because "the cellular metabolism in the brain stops" after death. Tr. 324:11–12. This leads to "more electrolyte[s] in the cell, and that draws more water into the cell." Tr. 324:15–16. Z.S.'s "autopsy report does not comment at all if [the edema] happened premortem or postmortem," and Dr. Alexandrescu does not believe it to be the former. Tr. 328:20–21.

In this case, "it[is] a mild change that is common in postmortem intervals that are above 24 hours[.]" Tr. 328:25. She continued, "in the absence of increased brain weight, in the absence of herniation or a fullness of the temporal lobes, [there is no] support to think that this is a premortem edema, but the changes are most consistent with postmortem physiological swelling." Tr. 329:1–6. Dr. Alexandrescu explained that she prefers to use the term swelling because "it[is] difficult to distinguish between postmortem and premortem edema." Tr. 329:11–13. Citing the Berger[31] article, Dr. Alexandrescu asserted that "the best way to say if an edema was mild and moderate[and] was premortem or postmortem is to assess the presence of bilateral tonsillar herniation and fullness of the temporal lobe." Tr. 335:12–15 (citing Resp't's Ex. F, Tab 6). She warned that "you cannot use just a mild or moderate assessment of the gyri and sulci." Tr. 336:8–

[29] Atrophy is "a wasting away; a diminution in the size of a cell, tissue, organ, or part." *Dorland's* at 175.
[30] N. Berger, et al., *Racking the Brain: Detection of Cerebral Edema on Postmortem Computer Tomography Compared with Forensic Autopsy,* 84(4) EUR. J. RADIOL. 643–51 (2015).
[31] *See id.*

9. Rather, she continued, "[y]ou have to put it in the context with the brain weight, with the presence or absence of herniation, particularly bilateral tonsillar herniation and fullness of the temporal lobe[,] and to put that then in the clinical context." Tr. 336:10–15.

Responding to Dr. Ophoven's assertion that there was evidence of spongiosis in this case, Dr. Alexandrescu asserted that "spongiform encephalopathy [] is a completely different type of disease that is not applicable [here]." Tr. 338:2–4. This case involves "nothing more than [a] coincidental, a temporal coincidence." Tr. 341:12. At Z.S.'s age, "from birth to one year and a half, is the time when the children get vaccinated the most." Tr. 341:5–7. That means, if there is a tragic event that occurs during that time, "there will be a vaccination close to the event." Tr. 341:10. Dr. Alexandrescu was unable to specify what caused Z.S.'s death. Tr. 344:4. She stated that the entire premise of vaccination-causation was based on edema in the brain, but "that[is] an overinterpretation of a normal brain with postmortem changes." Tr. 342:15–17. Dr. Alexandrescu agreed that interpreting "the expansion of the gyri and the narrowing of the sulci is subjective and should not be interpreted as one – as a per se sign of anything but needs to be placed [i]n a context that includes weight, includes herniation, includes clinical history." Tr. 350:24–25, 351:1–4. The fact that the autopsy report notes there is no unequivocal link between Z.S.'s vaccinations and death, is in Dr. Alexandrescu's opinion, less telling than the inverse. Tr. 351:12–20. She opined that the report does not state "the association is equivocal," and she "would have been more worried if [the coroner] said that [it was]." Tr. 352:4–7.

d. Respondent's Expert, Max Wiznitzer, M.D.

Dr. Wiznitzer received his medical degree from Northwestern University in 1977. Resp't's Ex. E at 1, ECF No. 38-7. Dr. Wiznitzer completed a residency in pediatrics at the Children's Hospital Medical Center in Cincinnati, OH in 1980. *Id.* He also completed fellowships in developmental disorders at the Cincinnati Center for Developmental Disorders in 1981, pediatric neurology at the Children's Hospital of Philadelphia in 1984, and higher cortical functions through the NIH's National Research Service Award in 1986. *Id.* He has served as an associate pediatrician and associate neurologist at the University Hospitals of Cleveland since 1986. *Id.* at 2. Dr. Wiznitzer has been an associate professor at Case Western Reserve University in the topics of international health since 1994, and of pediatrics and neurology since 2013. *Id.* at 1–2. He has received numerous grants for his research. *Id.* at 3–4. He holds several editorial roles, serves on many advisory boards, and has memberships in professional and scientific societies and committees. *Id.* at 5–9. Dr. Wiznitzer's curriculum vitae lists hundreds of publications, including lectures, articles, book chapters, and abstracts of which he is a listed author. *See id.* at 10–62.

During the hearing, Dr. Wiznitzer explained that as part of his role as a neurologist at Children's Hospital in Cincinnati he "sees patients . . . [with] a variety of different neurological conditions[,]" including epilepsy, neurodevelopmental disabilities, and autism. Tr. 358:3–25, 359:1–5. Dr. Wiznitzer noted that he has been involved in "developing [the] diagnostic criteria for different neurological injuries . . . to be used in vaccine safety studies." Tr. 360:10–25, 361:1. He indicated that he is board certified in pediatrics, neurology with special qualifications in child neurology, and the neurodevelopment of disabilities. Tr. 359:14–22. Dr. Wiznitzer has testified in prior Table encephalopathy cases in the Program. Tr. 362:9–12. Respondent offered Dr. Wiznitzer

as an expert in pediatric neurology without objection, and I recognized him as such. Tr. 361:22–25, 362:1–8.

Dr. Wiznitzer's expert report was concise. *See* Resp't's Ex. D, ECF No. 38-6. He noted that Z.S.'s autopsy "demonstrated cerebral edema on macroscopic and microscopic examinations of the brain with no reported evidence of herniation." *Id.* at 3. He noted that "[i]n the absence of herniation and its effects on brainstem function, including respiration and cardiovascular control, it is unlikely that the cerebral edema on autopsy is the cause of death." *Id.* If Z.S. died as a result of the edema, Dr. Wiznitzer argued that "there would be evidence of cerebral herniation." Tr. 374:16–18. He noted there were "no structural abnormalities indicative of cerebral edema, no evidence of infection, no evidence of [a] diffuse or focal tumor, and no evidence of metabolic disturbance." Tr. 375:13–19. Dr. Wiznitzer further noted no evidence of a Table encephalopathy based on "no abnormally decreased level of consciousness . . . or clinical evidence of increased intracranial pressure." Resp't's Ex. D at 3. He concluded that Z.S.'s "irritability was a manifestation of the discomfort from her immunization[s] and not a symptom of an acute encephalopathy." *Id.*

Dr. Wiznitzer testified about the distinction between the general definition of encephalopathy and the use of the term in the context of the Vaccine Injury Compensation Act. In clinical practice, Dr. Wiznitzer agreed that encephalopathy refers to "a disorder of the brain that affects brain function or structure." Tr. 363:7–8. To satisfy the requirement for a Table encephalopathy however, Petitioner must show an altered mental state or impairment in consciousness. Tr. 363:16–24. Dr. Wiznitzer continued that this can manifest through the lack of awareness of people around you or poor eye contact, and "it should be a change in consciousness that results in[,] or should result in[,] admission to a hospital." Tr. 364:17–19. There is "a clinical consequence, that the brain is[not] right and it[is] causing you not to function correctly." Tr. 365:17–19.

He noted that Z.S., according to family reports, "was acting okay[]" post vaccination. Tr. 367:4. Dr. Wiznitzer opined that tiredness and fever are not sufficient indicators of encephalopathy and are common responses to vaccination. Tr. 368:5–10. Dr. Wiznitzer noted that Z.S.'s father did not "notice any change or impairment in her consciousness." Tr. 367:15–16. Instead, "[s]he just did[not] feel good." Tr. 368:17–18. If Z.S. was experiencing a Table encephalopathy, she would have been in a stupor or coma and impossible to wake. Tr. 369:5–7. She "would not have been able to localize pain," or recognize her parents. Tr. 369:12–13. Dr. Wiznitzer also identified several "clinical signs and symptoms that people have within [sic] increased intracranial pressure: [c]omplaints of headache or acting as if your head hurts, vomiting, [or a] progressive worsening level of consciousness." Tr. 371:25, 372:1–3. Dr. Wiznitzer clarified that "sleep, by definition, is a change in consciousness." Therefore, there must be a way "to differentiate between the sleep state and an impairment in consciousness[,] which would be stupor or coma." Tr. 389:14–18.

He opined that because "a child dies within 24 hours of a vaccination, it does not mean that they definitely had an encephalopathy." Tr. 380:14–16.

V. Legal Arguments

a. Petitioners' Briefings

Petitioners initially asserted that Z.S.'s death was caused-in-fact by the vaccinations she received on November 18, 2014. Pet. at 1. In pre-hearing submissions, Petitioners then noted that "[t]he facts of this case also meet the definition of 'encephalopathy' as that term is defined under the [QAIs] of the Vaccine Table." Pet'r's Pre-Hrg. Br. at 7. Petitioners' expert testified that Z.S. suffered from an acute encephalopathy as defined by the Vaccine Injury Table. Dr. Ophoven relied on Z.S.'s moderate cerebral edema, "opining the brain was swollen based on the appearance and texture of the brain, the weight of the brain based on the child's anticipated growth and development, and microscopic images of the brain." Pet'r's Post-Hrg. Br. at 13.

Relying on their expert's testimony, Petitioners argue that Z.S. suffered an encephalopathy consistent with the NIH definition: "diffuse disease of the brain that alters brain function or structure." *Id.* at 12. As further support, Petitioners relied on Dr. Ophoven's explanation that the cerebral edema noted in Z.S.'s autopsy is evidence of a brain that is abnormal and swollen. *Id.* Petitioners testified that the change in Z.S.'s behavior is additional evidence of altered brain function. *Id.* at 18–19. Petitioners further testified that Z.S. showed signs of decreased consciousness during lunchtime and nap time. *See id.* In post-hearing briefings, Petitioners argue that "in dying, [Z.S.] suffered the most profound and permanent change in level of consciousness." Pet'r's Reply at 5.

Petitioners' post-hearing briefings also argue that Respondent's experts did not provide reliable evidence to rebut a Table encephalopathy claim. Dr. Vargas, Petitioners assert, "did not testify regarding encephalopathy and did not provide an opinion as to whether or not [Z.S.] suffered an encephalopathy." *Id.* at 11. Dr. Alexandrescu does not diagnose encephalopathy as a part of her practice. *Id.* at 14. More importantly, she agreed that edema usually does not accompany SIDS and can occur without herniation. *Id.* at 14–15. Dr. Wiznitzer has testified in at least 90 vaccine injury cases on behalf of Respondent. *Id.* at 15. Furthermore, Dr. Wiznitzer agreed that "loss of consciousness sustained from [a] point on until either the time of death or 24 hours would meet the criteria for Table encephalopathy." Tr. 388. This, asserts Petitioners, is what happened in this case.

b. Respondent's Briefings

In his post-hearing brief, Respondent notes that "Petitioners no longer appear to be asserting a causation-in-fact claim." Resp't's Resp. at 8. Table encephalopathy claims require preponderant evidence of the "definition of encephalopathy under the Vaccine Table[, which] is a more narrow interpretation than what is commonly accepted in the medical community." *Id*. (citing *Paz v. Sec'y of Health & Hum. Servs.*, No. 14-290V, 2015 WL 4557119, at *5 (Fed. Cl. Spec. Mstr. June 23, 2015)). Respondent asserts that Z.S. did not suffer from a Table encephalopathy because Z.S. did not demonstrate a significantly decreased level of consciousness. In accordance with the QAIs, he argues Z.S. did not demonstrate a decreased or absent response to her environment, decreased or absent eye contact, or inconsistent or absent responses to external stimuli. Furthermore, the QAIs specifically address all of Z.S.'s symptoms. Respondent asserts, "[a]s Dr. Wiznitzer testified, [P]etitioners' description of [Z.S.'s] behaviors indicate that she

simply 'did[not] feel good' due to the known, usual effects of being vaccinated." Resp't's Resp. at 14 (citing Tr. 367–68).

Respondent also disputes Petitioners' assertion that there is evidence that Z.S. had increased intracranial pressure. He addresses, in turn, the four factors that Dr. Ophoven relied on to reach that conclusion: "(1) her training and experience, (2) [Z.S.'s] brain weight, (3) brain swelling observed by the [medical examiner], and (4) the presence of water in the brain cells." Resp't's Resp. at 14. Dr. Ophoven opined that water in the brain cells was the cause of the swelling in Z.S.'s brain. Tr. 175. Despite Dr. Ophoven's reliance on the NIH's definition of encephalopathy to use the terms "swelling" and "edema" interchangeably, Respondent notes that the definition "does not mention swelling." Resp't's Resp. at 14. More importantly, Dr. Alexandrescu opined that Z.S.'s cerebral edema occurred postmortem. The parties also disagree on whether Z.S.'s brain weight was actually normal. Respondent relies on Z.S.'s body measurements during autopsy to assert that her brain was not heavy. Lastly, Respondent reiterates that "Dr. Ophoven is not board certified in pathology,[32] has not done a fellowship in neuropathology, last worked in a hospital in 1996, and last worked as a practicing forensic pathologist in 2010." *Id.* at 12, 14. In contrast, Dr. Alexandrescu is "a fellowship trained, board-certified neuropathologist." *Id.* at 18.

Z.S.'s death is "the only requirement of a Table encephalopathy that has been met here." *Id.* at 19. Respondent asserts that this is not enough. *Id.* He argues that Petitioners have not offered preponderant evidence that Z.S. "suffered the clinical manifestations of an acute encephalopathy that resulted in her death." *Id.*

Although Respondent and Petitioners agree that this claim is no longer based on causation-in-fact, Respondent notes that "Dr. Ophoven confirmed that she had no medical theory or biological mechanism of vaccine causation for [Z.S.'s] death." *Id.* (citing Tr. 167–69). Respondent also notes that Dr. Ophoven "attributed [Z.S.'s] death to [her] vaccination[s] based on timing and [the] lack of alternative causes." Resp't's Resp. at 20 (citing Tr. 176–77). He cites the Federal Circuit's holding that "neither a mere showing of a proximate temporal relationship between vaccine and injury, nor a simplistic elimination of other potential causes of injury" is sufficient to establish causation." *Moberly v. Sec'y of Health & Hum. Servs.*, 592 F.3d 1315, 1323 (Fed. Cir. 2010). That is true "even if the off-Table injury occurs within a time period set forth in the Table." *Id.* He concludes that Petitioners have not established a Table encephalopathy or provided evidence of causation-in-fact; therefore, he does not have a burden to present any rebuttal evidence. Resp't's Resp. at 21–22.

VI. Analysis[33]

[32] Dr. Ophoven testified that she is "board certified in forensic pathology and anatomic pathology. Pediatric pathology boards did not exist." Tr. 91:5–7.

[33] Dr. Vargas submitted a coherent and informative written report. However, during her testimony, Dr. Vargas was equivocal and nonresponsive. She did not agree that certain words have specific meanings in the medical field and questioned the general meaning of several non-medical words. Tr. 253:19–20, 254:4–5, 257:23–24, 258:21–22, 260:2. On one occasion, I was forced to intervene in the cross-examination of Dr. Vargas to get a direct answer to a question. Tr. 298:13–25, 299:1–23. She also reversed herself on more than one occasion. Tr. 276:10, *But see* Tr. 278:4–5, 284:3–7. As a result, her testimony was less helpful, and I did not rely on her opinion in this Decision.

To receive compensation under the Vaccine Act, a petitioner must demonstrate either that: (1) the petitioner suffered a "Table injury" by receiving a covered vaccine and subsequently developing a listed injury within the time frame prescribed by the Vaccine Injury Table set forth at 42 U.S.C. § 300aa-14, as amended by 42 C.F.R. § 100.3; or (2) that the petitioner suffered an "off-Table injury," one not listed on the Table, as a result of his receiving a covered vaccine. *See* 42 U.S.C. §§ 300aa-11(c)(1)(C); *Moberly*, 592 F.3d at 1321; *Capizzano v. Sec'y of Health & Hum. Servs.*, 440 F.3d 1317, 1319–20 (Fed. Cir. 2006). Off-Table claims require a petitioner to prove that the alleged injury was caused-in-fact by a Table vaccine.

In the seminal case of *Althen v. Sec'y of the Dept. of Health & Hum. Servs.*, the Federal Circuit set forth a three-pronged test used to determine whether a petitioner has established a causal link between a vaccine and the claimed injury. *See* 418 F.3d 1274, 1278–79 (Fed. Cir. 2005). The *Althen* test requires petitioners to set forth: "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury." *Id.* at 1278. To establish entitlement to compensation under the Program, a petitioner is required to establish each of the three prongs of *Althen* by a preponderance of the evidence. *See id.*

Petitioners in this case have abandoned any argument that Z.S.'s death was an off-Table injury, caused-in-fact by her vaccinations. They did not offer evidence of a biological mechanism, pursuant to *Althen* prong one; nor did they offer evidence of a clear and logical pathogenesis of the injury that ultimately led to Z.S.'s death, pursuant to *Althen* prong two. They argue only that following her DTaP vaccination, Z.S. suffered an encephalopathy that ultimately resulted in her death, and that "[t]his is a Table injury case." Pet'r's Post-Hrg. Br. at 7.

The statute's definition of encephalopathy in December of 2015 was the "significant acquired abnormality of, or injury to, or impairment of function of the brain. Among the frequent manifestations of encephalopathy are focal and diffuse neurological signs, increased intracranial pressure, or changes lasting at least 6 hours in level of consciousness with or without convulsions." 42 U.S.C. § 300aa-14(b)(3)(A). The QAIs further defined Table encephalopathy in the Code of Federal Regulations: "[f]or children less than 18 months of age who present without an associated seizure event, an acute encephalopathy is indicated by a significantly decreased level of consciousness lasting for at least 24 hours." 42 C.F.R. § 100.3(b)(2)(i)(A). An increase in intracranial pressure "may be a clinical feature of acute encephalopathy in any age group." 42 C.F.R. § 100.3(b)(2)(i)(C). Petitioners must also show that acute encephalopathy is followed by the persistence of chronic encephalopathy for more than six months beyond the date of vaccination.

A significantly decreased level of consciousness is indicated by the presence of at least one or more of the following clinical signs: "(i) decreased or absent response to environment (responds, if at all, only to loud voice or painful stimuli); (ii) decreased or absent eye contact (does not fix gaze upon family members or other individuals); or (iii) inconsistent or absent responses to external stimuli (does not recognize familiar people or things)." 42 C.F.R. § 100.3(b)(2)(i)(D). "The following clinical features alone or in combination, do not demonstrate an acute encephalopathy or a significant change in either mental status or level of consciousness as

described above: [s]leepiness, irritability (fussiness), high-pitched and unusual screaming, persistent inconsolable crying and bulging fontanelle." 42 C.F.R. §100.3(b)(2)(i)(E).[34]

The QAIs further define a significantly decreased level of consciousness as one that "implies a state of diminished alertness that is much more than mere sleepiness or inattentiveness . . . [it] requires markedly impaired or strikingly absent-responsiveness to environmental or external stimuli for a sustained period of at least 24[]hours." *Wright v. Sec'y of Health & Hum. Servs.,* No. 12-423, 2015 WL 6665600, at *6 (Fed. Cl. Spec. Mstr. Sept. 21, 2015) (quoting *Waddell v. Sec'y of Health & Hum. Servs.*, No. 10-316, 2012 WL 4829291, at *7 (Fed. Cl. Spec. Mstr. Sept. 19, 2012)).

In order to establish a Table claim for entitlement resulting from a DTaP vaccination, a petitioner must show that the encephalopathy manifested within seventy-two hours of vaccine administration. 42 C.F.R. §100.3 (effective July 23, 2015 to March 20, 2017). There is no dispute between the parties that Z.S.'s death occurred within seventy-two hours of her vaccination. Z.S.'s death was a superseding factor that nullifies a showing of a chronic encephalopathy. Petitioners assert that Z.S.'s encephalopathy was the intervening injury, and therefore, this timeframe is within the window for a Table encephalopathy. *See id.*

The material question in this case is whether Petitioners have presented preponderant evidence of a Table encephalopathy. Petitioners note, and the medical record supports, that Z.S. was healthy prior to vaccination, and her sudden death would qualify any preceding encephalopathy as acute. There is nothing in the record to dispute this presumption. At issue here is whether the medical records, death investigation, autopsy findings, and Petitioners' account of the hours between Z.S.'s vaccination and death provide sufficient evidence of an encephalopathy. That question is further complicated by a dispute over what, if any, distinction there is between the medical definition of encephalopathy and a Table encephalopathy. For Petitioners to prevail, they must provide preponderant evidence that Z.S. suffered from an encephalopathy and that said encephalopathy meets the definition articulated in the QAIs for a Table injury.

Dr. Ophoven defined encephalopathy as diffuse disease in the brain. During the hearing, there was substantial discussion of how to define various medical terms, but what constitutes disease was not covered. Dorland's Illustrated Medical Dictionary[35] defines "disease" as "any deviation from or interruption of the normal structure or function of a part, organ, or system of the body as manifested by characteristic symptoms and signs; the etiology, pathology, and prognosis may be known or unknown." *See Dorland's* at 527. The key provision of this definition is the explanation that the manifestation of symptoms and signs help determine whether a deviation or interruption is present. Fever, irritability, and lethargy can certainly be signs that a child is unwell. However, without more, those symptoms are too common to identify a deviation or interruption of a specific part, organ, or bodily system, such as the brain. *See Lankford v. Sec'y of Health &*

[34] The Vaccine Injury Table statute has similar but slightly different language: "Signs and symptoms such as high pitched and unusual screaming, persistent inconsolable crying, and bulging fontanel are compatible with an encephalopathy, but in and of themselves are not conclusive evidence of encephalopathy." 42 U.S.C. § 300aa-14(b)(3)(A). This difference has no bearing on my Decision as the language is consistent.

[35] Dorland's defines encephalopathy as a degenerative disease of the brain, which is a more profound and specific deviation of the function of the brain. *See Dorland's* at 614.

Hum. Servs., 37 Fed. Cl. 723, 725–26 (1996) (affirming the special master's reliance on the medical expert's assertion that symptoms including fever, diminished appetite, drowsiness, localized swelling at the injection site, and difficult arousal are no more pronounced in severity than the adverse systemic reactions typically encountered in the administration of that vaccine). Dr. Wiznitzer[36] fine-tuned this point by explaining that these symptoms are not sufficient indicators of encephalopathy but are common responses to vaccination. For comparison, Dr. Wiznitzer identified several applicable signs and symptoms of encephalopathy, such as coma, stupor, headache, vomiting, and other evidence of decreased consciousness.

Notably, the Federal Circuit has cautioned against discounting death as evidence of encephalopathy. *Jay v. Sec'y of Health & Hum. Servs.*, 998 F.2d 979, 984 (Fed. Cir. 1993) (finding that the petitioners were entitled to judgment as a matter of law where the "undisputed facts of record . . . include that an otherwise healthy child received a [diphtheria-pertussis-tetanus ("DPT")] shot; the DPT shot caused fever[and limpness;] the child missed his normal nightly feeding; the child died within 18 hours of the shot; the autopsy was inconclusive; and a medical expert testified, uncontradicted, that the DPT shot caused the death, the medical theory being that an encephalopathy occurred."). In *Jay,* the special master, in the absence of rebuttal evidence, refused to consider the child's death as evidence of the encephalopathy on a motion for summary judgment. *See id.* at 983. The Federal Circuit, however, noted that "[n]otwithstanding two hearings and numerous written submissions, [the Department of Health and Human Services] ha[d] not contradicted [the petitioners'] evidence." *Id.*

In the present case, Respondent has disputed Petitioners' evidence by way of expert testimony and medical literature. This case is not one wherein an expert presented testimony that "reflects a reasoned evaluation of undisputed facts and stands uncontradicted by any opposing medical opinion." *See Lankford*, 37 Fed. Cl. at 726. Indeed, the death of Z.S. has been discussed at length by experts from both sides. It is, as Petitioners assert, the most "profound and permanent change in level of consciousness" that can occur. *See* Pet'r's Reply at 5. However, as noted in *Lankford,* "death is recognized to be a compensable Table injury when medically identified as an acute complication or sequela of an encephalopathy." *See* 37 Fed. Cl. at 726. The Federal Claims Court, in distinguishing *Jay,* noted that Petitioners cannot assert that "because a death occurred, it would be more logical to assume the adverse clinical signs that preceded that event bespoke an encephalopathic process rather than simple drowsiness." *Id.* Rejecting that argument, *Lankford* held that the statute demands that "a medically justified determination of encephalopathy must precede the occurrence of death." *Id.*

Petitioners' expert Dr. Ophoven asserted that cerebral edema is inherently encephalopathic. She asserted that encephalopathy reflects abnormal brain tissue that is typically associated with brain swelling. Tr. 114:14–15. She did not provide any authority for this assumption or address Dr. Alexandrescu's rebuttal. By comparison, Dr. Alexandrescu explained that not all brain swelling is encephalopathy (for example, when caused by hyponatremia), and not all encephalopathy is characterized by edema (in the case of atrophy). She also disagreed with Dr. Ophoven's contention that encephalopathy is always diffuse and gave a counter example of a focal brain tumor. Dr. Alexandrescu's examples were extremely helpful, and her testimony was

[36] While Dr. Wiznitzer provided helpful testimony as it relates to identifying an encephalopathy, his argumentative nature and tone was at times, counterproductive.

persuasive. Therefore, I do not find that Petitioners have presented preponderant evidence that cerebral edema is always encephalopathic.

The QAIs note that for a child Z.S.'s age who presents without seizure, the presence of one or more decreased consciousness factors indicate an acute encephalopathy. Petitioners were asked if Z.S. exhibited any signs of decreased consciousness. Ms. Adal noted that Z.S. could recognize her mother's voice and other sounds around her. She recognized her family members, and she did not lose consciousness. Ms. Adal noted the lack of other symptoms and signs of disease, specifically vomiting, or headache. Ms. Adal testified that she did not notice Z.S. acting differently and that Z.S. just seemed tired. Ms. Adal and Mr. Shiel both used the word "lethargic" to describe Z.S. and described her as hot, fussy, and tired. Mr. Shiel testified that Z.S. was not her "bouncy" self. He agreed that Z.S. was perfectly conscious. He reiterated that she did not have any decreased consciousness until she died in her sleep. Mr. Shiel also testified that he would have responded to any unusual noise he heard from her during the night.

The QAIs specifically note that sleepiness and fussiness, even when taken together, are insufficient, without more, to establish a Table encephalopathy. In prior cases, special masters have also determined that diminished alertness requires little to no responsiveness to environmental or external stimuli. *Wright*, 2015 WL 6665600, at *6. There is no evidence that Z.S. did not recognize or respond to her parents or did not maintain eye contact. There is no evidence that she only responded to loud or painful stimuli. There is no evidence that she was in a coma or stupor-like state. Her mother's account that she was more difficult to wake from her nap seems more consistent with the sleepiness type of behavior that should be distinguished from an actual "state of diminished alertness" exemplified in those more severe examples. There is no evidence of seizure, tremor, headache, paralysis, or loss of or decreased consciousness. Z.S.'s behavior, in the hours between vaccination and bedtime, does not support a finding of decreased consciousness as required for a Table encephalopathy. In this case, Petitioners did not present preponderant evidence to rebut their admitted initial belief, that Z.S.'s tiredness and fussiness were caused by discomfort from her vaccinations.

Although Dr. Ophoven asserted that cerebral edema is de facto encephalopathic, she also relied on autopsy findings to support her contention that Z.S. suffered from an acute encephalopathy. Petitioners did present evidence, and Respondent's experts did not dispute, that edema can be evidence of encephalopathy. Dr. Ophoven testified that a fatal edema typically is evident because of intercranial pressure or "interference with vital signs through the process of herniation." Tr. 161:19–20. Interference with vital signs is consistent with the Dorland's definition for encephalopathy, a deviation, or interruption of function. *See Dorland's* at 614. It is also consistent with the Table definition of diminished consciousness. Petitioners assert that the widening of gyri and narrowing of sulci is evidence of intracranial pressure. Dr. Alexandrescu's explanation of the relationship between brain swelling, intercranial pressure, and injury is more nuanced. She testified that unlike a mild cerebral edema, significant brain swelling will increase the intercranial pressure and lead to fullness of the temporal lobe and tonsillar herniation that presses on the brainstem. These symptoms would be in addition to the less significant widening and narrowing that often occurs after death.

Drs. Ophoven and Alexandrescu both discussed the subjective nature of pathology. Dr. Alexandrescu specifically noted that "there[is] literature saying that the expansion of the gyri and narrowing of the sulci is subjective and should not be interpreted as one – as per se a sign of anything." Tr. 350:24–25, 351:1–2. The Berger[37] article supports Dr. Alexandrescu's assertion that the mild to moderate cerebral edema noted at autopsy occurred postmortem. Resp't's Ex. F, Tab 6. The authors identified increased brain weight as one criterion for antemortem edema, but they noted "the subjective assessment of flattened gyri and filled sulci," and included additional indicators such as "a swollen hippocampus, herniated cerebellar tonsils[,] and a midline shift in cases in which the edema is unilateral." *Id.* at 3. Both experts agree that fatal edema can lead to complications such as herniation and diminished consciousness. There is no evidence in the record of herniation or a midline shift, and the autopsy report does not address intercranial pressure. Given the medical literature in support of Dr. Alexandrescu's opinion of post-mortem edema, Dr. Ophoven's reliance on the autopsy note that edema is present is not preponderant evidence of encephalopathy.

Petitioners also rely on Z.S.'s November 18, 2014 wellness-exam for her baseline weight and height and argue that her brain was heavy and swollen at autopsy. However, Dr. Ophoven conceded that she underestimated the anticipated brain weight for a child with the height and weight recorded the last day of Z.S.'s life. Using the wellness-exam measurements proffered by Petitioners, along with their submitted medical literature,[38] Z.S.'s brain should have weighed 1,042 to 1,050 grams. The autopsy measurements proffered by Respondent would be consistent with a normal brain weight of 1,059 to 1,064 grams. Z.S.'s brain weight of 1,060 is within one standard deviation of either set of numbers, rendering the dispute moot. The autopsy itself provides the best evidence of whether the coroner believed there was a significant acquired abnormality of, injury to, or impairment of function of Z.S.'s brain. The comments from the general examination of the Z.S.'s head note "moderate cerebral edema" and "normal gross architecture and no obvious abnormalities." Pet'r's Ex. 8 at 7. A microscopic examination of the brain revealed "mild cerebral edema" with "development consistent with the child's age and no diagnostic microscopic pathologic changes." *Id.* at 9. These notations of mild and moderate edema are subjective, as evidenced by the coroner's use of different descriptors, and do not explicitly state or implicitly suggest swelling sufficient to cause abnormality, injury, or impairment that led to Z.S.'s death. The coroner's note that the brain is normal with no abnormalities further makes the point. The evidence in the record of Z.S.'s cerebral edema noted at autopsy is not preponderant evidence of a Table encephalopathy.

Without preponderant evidence of a Table encephalopathy, Respondent is under no burden to identify the cause of Z.S.'s injury. Dr. Ophoven noted in her written reports that the timing of Z.S.'s death in relation to her vaccinations, and the lack of alternate causes, is largely the basis for her opinion in this case. While those factors warrant further consideration of the applicability of a Table injury, neither is sufficient to establish a Table encephalopathy in this case. Furthermore, the medical history, behavioral changes, and autopsy report did not provide preponderant evidence that Z.S. suffered any of the following: significant acquired abnormality of, injury to, or impairment of function of the brain; increased intracranial pressure; or a significantly decreased level of consciousness to establish a Table encephalopathy.

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[37] *See* Berger, et al., *supra* note 30.

[38] *See supra* note 21.

VII. Conclusion

Petitioners' claim is solely one of a Table encephalopathy. There is no other theory, biological mechanism, or logical sequence of cause and effect for me to consider. There is not preponderant evidence that edema is per se encephalopathic. Despite the temporal relationship between Z.S.'s vaccinations and her death, there is not preponderant evidence that Z.S. suffered from encephalopathy during that time. Finally, there is not preponderant evidence that Z.S. suffered from a Table encephalopathy pursuant to the QAI factors. The QAIs provide guidance for identifying injuries in cases where there is little to no evidence or understanding. There must be some applicability of one or more of the defining factors for injury, lest we hold that any death occurring within 24 hours of vaccination is de facto vaccine caused. Given the childhood vaccination schedule, that position is untenable.

The death of a child is an unimaginable loss, and the lack of information available to medical professionals to provide answers when such a tragedy occurs can exacerbate the loss. To understand what happened in this case and why, the medical record, expert reports, medical literature, and hearing testimony were all thoroughly reviewed and considered, even if not explicitly referenced herein. Considering the totality of the record in this case, there is not preponderant evidence of a Table encephalopathy resulting from Z.S.'s November 18, 2014 vaccinations.

Accordingly, I have no choice but to DENY Petitioners' claim and DISMISS this petition.

IT IS SO ORDERED.

s/Herbrina D. Sanders
Herbrina D. Sanders
Special Master